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Report No. 01-09

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Psychosocial and Lifestyle Correlates of Premenstrual Symptoms among Military Women

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Report No. 01-09, supported by the US Army Medical Research and Material Command, Fort Detrick, MD, and the Research Triangle Institute, under research work unit Reimbursable, 6909. The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. Approved for public release; distribution unlimited. This research has been conducted in compliance with all applicable Federal Regulations governing the protection of human subjects in research.

ABSTRACT

Objective: This study examines the prevalence of premenstrual symptoms among a large, population-based sample of reproductive-age, active-duty women.

Method: A multivariate approach is used to evaluate the relative importance of psychosocial and lifestyle predictors of premenstrual symptoms or pain after controlling for demographic differences in cases and controls.

Results: Premenstrual symptoms were reported by nearly 2 out of every 3 reproductive-age women. Women reporting premenstrual symptoms were more likely to report other symptoms of menstrual dysfunction, 2 or more current medical conditions, migraines, and health care provider visits in the past year. After controlling for the protective effects of taking Depo-Provera™ and never being pregnant, younger age, trying to lose weight, heavier drinking, poorer self-perceived health, and overall job stress were the most significant predictors of premenstrual symptoms. The greatest risk factor was a high level of job stress, with an almost 3-fold increase in risk relative to those without symptoms.

Conclusions: Work stress may mediate the relationship between depression and premenstrual symptoms. Further research is needed to elucidate the biological interrelationships between work stress, hormonal function, and premenstrual symptomatology.

Key words: premenstrual symptoms, depression, stress, lifestyle, epidemiology, military

Acronyms: PMS = premenstrual syndrome; POWR = Perception of Wellness and Readiness Assessment; NHANES = National Health and Nutrition Examination Survey; CES-D = Center for Epidemiologic Studies - Depression Scale; SUDAAN = Survey Data Analysis; CNS = central nervous system; HPA = hypothalamic-pituitary-adrenal; PMDD = premenstrual dysphoric disorder; SE = standard error; OR = odds ratio; CI = confidence interval

INTRODUCTION

Premenstrual symptoms are commonplace among reproductive-age women. In only a small proportion of women with symptoms are they severe enough to interfere with functioning, meet diagnostic criteria for premenstrual syndrome (PMS), or prompt a health care visit. However, little is known about differences between women who do not report premenstrual symptoms and the up to 80% of women who do (1). With such a large proportion of women experiencing premenstrual symptoms, it is important to understand both the precursors and effects of such symptoms. Psychosocial variables, particularly depressive symptoms (2-6) have been strongly associated with premenstrual symptoms, leading some investigators to suggest that severe premenstrual symptoms may reflect an underlying depressive disorder (3,4). Perceived stress and physiological stress arousal have also been frequently associated with premenstrual symptoms (6-12). Lifestyle factors such as smoking (13,14), alcohol intake (7,15), physical activity (7), and working outside the home (16) have been associated with a variety of menstrual cycle problems. Medical disorders (6,17), general well-being (5), contraceptive use (17,18), and sociodemographic characteristics (6,17) have also occasionally been associated with premenstrual symptoms.

Unfortunately, many of the studies of premenstrual symptoms have small numbers of subjects and are restricted to clinical samples. Also, many of the psychosocial and lifestyle variables associated with premenstrual symptoms are related to each other. For example, recent stressful life events have been recognized as strong predictors of vulnerability to episodes of major depression (19), and work stress has been associated with both mental distress (20) and greater health problems (21). Stress and depression are well known correlates of alcohol and tobacco use. Little is known, however, about the interrelationship of these variables in women

with premenstrual symptoms. Despite evidence for physiological linkages between gonadal hormones, depression, and stress (22,23), we could locate no epidemiological study that has investigated how these types of variables interact in women with premenstrual symptoms and which risk factors may be more important than others with regard to PMS symptoms.

The majority of women in the military are of reproductive age. They are all employed and, in general, are in optimal health. The present study examined the prevalence of premenstrual symptoms among a large, population-based sample of reproductive-age, active-duty women. A multivariate approach is used to evaluate the relative importance of a large number of potential psychosocial and lifestyle predictors after controlling for demographic differences in women who reported recent premenstrual symptoms compared to those who did not.

METHODS

Data Source and Procedures

This study drew on a combined data set from two large-scale studies: (a) the 1998 Health Status of Military Women and Men in the Total Force, also called Total Force Health Assessment (24), and (b) the 1995 Perception of Wellness and Readiness Assessment, or POWR Assessment (25). The Total Force Health Assessment surveyed all segments of the military, except active-duty Navy and Marine Corps personnel. Navy and Marine Corps assigned to shore commands were studied using the POWR Assessment. In combination, these two surveys provide one of the first sets of population-based health status results for military personnel. Participants were selected to represent shore-based females and males in all paygrades of all segments of the U.S. military throughout the world. The Defense Manpower Data Center provided the data files for sample selection. The majority of responses were from mailed

questionnaires and a small proportion of the Navy and Marine Corps responses were from a subsample of group worksite questionnaire administrations. Most questionnaire items were drawn from brief standardized instruments with reliable psychometric properties applicable to a military population. Military advisors were extensively consulted on priority and acceptability of items to be included in the questionnaire. Data collection involved three questionnaire mailings with a "reminder/thank you" postcard sent between the first and second and between the second and third mailings. Mailout materials included a cover letter, questionnaire booklet, participant consent form and instructions, and postage-paid return envelope. Completed questionnaires were optically scanned with programmed editing checks. Additional manual and computerized edits were conducted to optimize the quality of the data. The combined overall response rate was 39%. Details of the probability sampling design and survey methodology have been reported elsewhere (24,26). Subjects included in the present study were 6,026 active-duty women of all branches of military service stratified by service, paygrade group, race/ethnicity, and location. To properly compute sampling weights, only those with complete data on strata variables were included in the present analyses. Exclusions included 684 women who were pregnant, using hormone replacement therapy, or were over age 49 years, and 153 women who did not answer the questionnaire item on premenstrual symptoms. These exclusions resulted in a final sample of 6,026 women representing 164,299 active-duty military women.

Measures

A special supplement for women on the questionnaire measured female-specific conditions, menstrual problems, and estrogen use. Most items were adapted from national health surveys or risk factor measures. Prevalence of female-specific conditions was assessed from a list of 12 conditions the respondent may have had during the past 3 months, regardless of

whether they resulted in a visit to sick call or a health care provider. Women who responded positively that they had "premenstrual symptoms or pain (PMS, premenstrual cramps)" were defined as cases (N=3861); those responding negatively to this item were defined as controls (N=2165).

Medical history variables. The medical history portion of the questionnaire consisted of 28 medical conditions that were adapted from the National Health and Nutrition Examination Survey (NHANES) III and excluded conditions primarily associated with the elderly, such as stroke and osteoporosis (27). Respondents indicated whether a health care provider had ever told them they had any of these. A summary variable of the total number of *current medical conditions* was created based on the number of positive responses to questionnaire items inquiring if the respondent still had the condition.

Health care use was assessed with 3 items asking about the number of times personnel went to a military medical facility for their own health care during the past 12 months and by 3 items asking about the number of times personnel went to a civilian doctor's office or outpatient clinic. These items were adapted from the 1994-1995 Health Care Survey of DoD Beneficiaries (28) and the DoD Women's Health Survey (29). The number of civilian and military facility *visits for illness or injury* or follow-up for illness or injury were combined into one measure, and visits for civilian and military facility *mental health visits* were combined into a second measure.

Lifestyle variables. As part of the lifestyle measures developed originally for the Navy's Health and Physical Readiness (H&PR) Study (30), respondents indicated the approximate number of days they took vitamins during the past 7 days, and how they perceived their physical fitness on a 5-point scale ranging from poor (0) to excellent (4). Current birth control method was assessed from a list of 14 possible methods taken from NHANES III (27), as was an item

inquiring whether the respondent had tried to lose weight during the past 12 months. Cigarette use was assessed by items concerned with amount and frequency of smoking tobacco and adapted from items used in the 1992 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel (31). Military personnel were defined as *"current" smokers* if they reported having smoked at least 100 cigarettes in their lifetime and having smoked in the past 30 days.

Measures of alcohol use included the *number of days that alcohol was consumed* in the past 30 days and the *number of alcoholic drinks consumed* on a typical day in the past 30 days. These items were also adapted from the 1992 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel (31).

Psychosocial variables. *Perceived physical health status* was assessed with the 5-item general health perception scale from the Rand 36-Item Health Survey (Version 1.0) adapted from the Medical Outcomes Study (32). This scale has been found to have good reliability and is scored from 0 to 100, with 100 representing optimal health status (33).

Depressive symptomatology was assessed with a shortened version of the Center for Epidemiologic Studies-Depression Scale (CES-D). The 4-point (0 - 3) scale ranged from rarely or none of the time (less than 1 day) to most or all of the time (5-7 days) and inquired about how often respondents "have felt this way during the past 7 days" (34,35). Seven items were scored such that the higher the score, the more depressive symptomatology indicated by the respondent. This index correlates 0.92 with the full CES-D and has a reliability of alpha = .83 (36). A cutoff of 6 was used as an indicator of depression.

Perceived job stress was assessed with the 12-item Job Pressures Scale (37). Respondents were asked to indicate how often they were "bothered" by the pressure or stresses

of their job on a 5-point scale ranging from not at all (0) to nearly all the time (4). An overall score was obtained by summing and averaging the raw subscale scores (38). Other psychosocial variables examined are listed in the footnote to Table 3 and have been described elsewhere (25).

Sociodemographic variables included sex, age, race/ethnicity, paygrade, marital status, numbers of previous pregnancies and births, age at first livebirth, and age at menarche.

Analytic Approach

To account for the complex sampling design, the Survey Data Analysis (SUDAAN) software system, developed by Research Triangle Institute (39), was used for statistical analysis of the survey data. The CROSSTAB procedure in SUDAAN was used to calculate weighted estimates of percentages and frequencies and estimates of their standard errors. Chi-square tests and significant *p* values were employed to evaluate the differences between cases and controls on demographic, medical history, lifestyle, and psychosocial variables. The LOGISTIC procedure was utilized to estimate odds ratios and 95% confidence intervals and to fit a hierarchical multiple logistic regression model examining the relationships between premenstrual symptoms and psychosocial variables controlling for sociodemographic and lifestyle variables.

RESULTS

The prevalence of premenstrual symptoms within the prior 3 months among active-duty women was 69%; that is, 2 out of every 3 reproductive-age women experienced symptoms. As shown in Table 1, premenstrual symptoms were significantly associated with all menstrual dysfunction measures except endometriosis (gynecologic disease). Women with premenstrual symptoms were especially more likely to report heavy periods (excessive menstrual flow), abdominal pain, and bleeding between periods. Women reporting premenstrual symptoms were

also more likely to report 2 or more current medical conditions, migraines, and health care provider visits for illness or injury, or mental health care in the past year.

Table 2 shows the demographic distribution of active-duty women with premenstrual symptoms compared with controls. Cases were significantly more likely than controls to be among younger and older age groups and among white and Hispanic women than among black women. Cases and controls did not differ with respect to marital status, paygrade, number of children, age at first livebirth, or age at menarche.

Selected potential lifestyle and psychosocial correlates are shown in Table 3. Women who reported premenstrual symptoms within the prior 3 months were significantly more likely than control women to have tried to lose weight in the past year, rated their physical fitness poorer, had never been pregnant, were current smokers and heavier drinkers, had perceived their health more poorly, had more depression symptoms, and reported a higher level of job stress. A significant interaction was found between depression and abdominal pain such that women with premenstrual symptoms reported more depression with abdominal pain than with either depression or pain alone. As expected, women using Depo-Provera™ in the past month were less likely to report premenstrual symptoms; there was no association with use of birth control pills.

To identify which of the significant bivariate correlates were most important to the report of premenstrual symptoms among these women, a hierarchical logistic regression model was fit by entering all significant variables shown in Table 3 in three successive blocks: demographic variables on the first step, lifestyle factors on the second step, and psychosocial factors on the third step. Two summary dummy variables were created to combine users of birth control pills, users of Depo-Provera, and nonusers into one variable, and another in which heavier drinkers were defined as those who drank on either 11 or more days in the past month or consumed 5 or

more drinks on a typical day versus those who drank less. Table 4 shows the final model in which depression, smoking, and physical fitness are no longer important and have been removed from the equation. The bivariate association with race/ethnicity was lost when lifestyle measures were included indicating that whites and Hispanics were at higher risk for premenstrual symptoms due to their weight/dieting behavior and/or heavier drinking patterns. (After excluding women who reported taking diet pills, attempt to lose weight was still significantly associated with premenstrual symptoms. Therefore, symptoms were not attributed to the pill taking.) Significant variables remaining in the equation after controlling for the protective effects of taking Depo-Provera and never being pregnant, were young age (those less than 20 years of age at twice the risk of premenstrual symptoms than those aged 35+), trying to lose weight, heavier drinking, poorer self-perceived health, and overall job stress. The greatest risk factor for premenstrual symptoms was a high level of job stress, with an odds ratio of almost 3 relative to women without symptoms.

DISCUSSION

As in civilian population samples, the prevalence of premenstrual symptoms reported among military women was high. The 64% 3-month prevalence among military women is consistent with the 55% to 73% current prevalence found in other nonclinical samples, despite variation in the symptom measures used across studies (3, 40, 41). The considerable overlap in reports of premenstrual symptoms with that of other menstrual complaints has also been noted in a few clinical studies (2, 42) and has been attributed to a possible disruption in prostaglandin synthesis (42) or elevated estrogen/progesterone ratios (2).

Of the several lifestyle factors examined, only attempt to lose weight and heavier alcohol drinking were significant in multivariate analysis. This is consistent with the greater alcohol use

found in studies of PMS (15,18). It is of potential relevance that studies of other significant menstrual complaints, such as bleeding between periods, have found more important associations with smoking than with alcohol consumption (14). Such findings suggest that the effects of lifestyle factors may be phase-specific.

The findings of this study are consistent with the bivariate associations found between depression and premenstrual symptoms and pain found in smaller samples of women (3, 41-43). The association between premenstrual depression and premenstrual pain observed by Bancroft and Rennie (43) was identified as an interaction in the current study. Also of interest in the present study was the finding that when the attempt to lose weight was controlled, the association with depression was no longer significant. In another study that found a premenstrual sweet food craving associated with depressive mood, a possible serotonin link between premenstrual symptoms and depression was suggested (42). It is possible that a premenstrual craving is related to obesity and/or dieting behavior, which in turn is associated with depression. This possibility is also consistent with a serotonergic-gonadal hormonal link, supported by increasing evidence from a variety of animal and human studies that serotonin function is affected by estrogen (44).

The fact that depression is approximately twice as common among women as men (45-47), and that the incidence of depression and disturbed mood increases in girls with the onset of puberty and in perimenopausal women (46, 47), suggests that gonadal hormones play an important role in depression and regulation of mood. Recent findings of lower estradiol levels in the follicular phase of the menstrual cycles of women with depression than non-depressed women have implicated an interaction between estrogen and the central nervous system (CNS) operating via the hypothalamic-pituitary-gonadal axis and the hypothalamic-pituitary-adrenal

(HPA) axis (9,10). Normal levels of estradiol during the luteal phase in women with depression suggest that such an interaction is multidimensional and potentially modulated by other CNS and hormonal systems. The present findings would suggest these systems are mediated by stress.

Numerous studies show stress to affect both the reproductive axis and psychosocial functioning (8-11). The strongest predictor of premenstrual symptoms in this study, job stress, was associated with an almost 3-fold risk of symptoms after controlling for all other variables. To our knowledge, this is the first epidemiological study to identify an association between job stress and premenstrual symptoms. This unique finding, among a large sample of young military women, is generally consistent with the positive relationship found between the probability of having PMS and working outside the home (16), and the greater current life stress and history of trauma reported in women with premenstrual dysphoric disorder (PMDD) (48). It is largely consistent with the high negative affect scores found only in the premenstrual phase among young women who reported experiencing stressful life changes in the past year (49). The strength of the association found in this study, together with previous findings that few women with premenstrual symptoms report work impairment (40), suggests that work stress may be internalized in young, symptomatic, employed women rather than reflected in their work performance. It also suggests that work stress intervention efforts may help ameliorate premenstrual symptoms. Work stress, perhaps through cycle phase-related elevated cortisol levels, may represent an important additional biological link in postulated serotonergic-estrogen pathways. Supporting biological evidence comes from studies that have found that stress-induced amenorrhea activates the HPA axis and increases cortisol secretion (9) and that greater norepinephrine to cortisol ratios have been found in women with PMDD (45). The combined

examination of clinical and epidemiological findings may help elucidate the risk factors and biological mechanisms involved in the experience of premenstrual symptoms.

One limitation of the present study is the lack of a standardized assessment of premenstrual symptoms and other menstrual complaints. Further, there was no available measure of symptom severity; it is unknown how many women may have met diagnostic criteria for PMS (16). It will be important to determine the extent to which the present results are reproducible among women with severe symptomatology or PMS. As is usual in military mail surveys, the response rate was low, with the high mobility of the population accounting for the majority of undeliverable/incorrect addresses and nonresponses. There is no a priori reason, however, to believe women with premenstrual symptoms were more or less likely to return questionnaires than nonsymptomatic women. Another limitation of any self-report data is that they are subject to memory errors and recall bias. Also with cross-sectional data, causal associations cannot be determined. Although modeled as predictors in the present study, psychosocial variables may also be conceived of as outcomes of experiencing premenstrual symptoms. It may be possible, for example, that premenstrual symptoms, including depressed mood, influence self-reports of job stress. To overcome these limitations, the present results should be prospectively confirmed in longitudinal epidemiological studies that strive to determine cycle phase-specific changes in young, employed women.

Acknowledgments

Report Number 01-09 was supported by the US Army Medical Research and Material Command, Frederick, MD and the Research Triangle Institute, Research Triangle Park, NC under work unit REIMBU-6909. The views expressed in this report are those of the authors and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. Approved for public release; distribution unlimited. This research has been conducted in compliance with all applicable Federal Regulations governing the protection of human subjects in research.

References

1. Mortola JF. Premenstrual syndrome. In: Goldman MB, Hatch MC, editors. Women & Health. San Diego: Academic Press, 2000, 114-125.
2. Steege JF, Stout AL, Rupp SL. Relationships among premenstrual symptoms and menstrual cycle characteristics. Obstet Gynecol 1985;65:398-402.
3. Hallman J. The premenstrual syndrome - an equivalent of depression? Acta Psychiatr Scand 1986;73:403-411.
4. West CP. The characteristics of 100 women presenting to a gynecological clinic with premenstrual complaints. Acta Obstet Gynecol Scand 1989;68:743-747.
5. Rosen LN, Moghadam LZ, Endicott J. Relationship between premenstrual symptoms and general well-being. Psychosomatics 1990;31:47-54.
6. Keye WR, Hammond DC, Strong T. Medical and psychologic characteristics of women presenting with premenstrual symptoms. Obstet Gynecol 1986;68:634-637.
7. Deuster PA, Adera T, South-Paul J. Biological, social, and behavioral factors associated with premenstrual syndrome. Arch Fam Med 1999; 8:122-128.
8. Woods NF, Lentz MJ, Mitchell ES, Heitkemper M, Shaver J, Henker R. Perceived stress, physiologic stress arousal, and premenstrual symptoms: group differences and intra-individual patterns. Res Nurs Health 1998; 21:511-523.
9. Woods NF, Lentz MJ, Mitchell ES, Shaver J, Heitkemper M. Luteal phase ovarian steroids, stress arousal, premenses perceived stress, and premenstrual symptoms. Res Nurs Health 1998; 21:129-142.
10. Brown MA, Lewis LL. Cycle-phase changes in perceived stress in women with varying levels of premenstrual symptomatology. Res Nurs Health 1993;16:423-429.

11. Woods NF, Mitchell ES, Lentz MJ. Social pathways to premenstrual symptoms. Res Nurs Health 1995; 18:225-237.

12. Fontana AM, Badawy S. Perceptual and coping processes across the menstrual cycle: an investigation in a premenstrual syndrome clinic and a community sample. Behav Med 1997; 22:152-159.

13. Sloss EM, Frerichs RR. Smoking and menstrual disorders. Int J Epidemiol 1983; 12:107-109.

14. Kritz-Silverstein D, Wingard DL, Garland FC. The association of behavior and lifestyle factors with menstrual symptoms. Journal of Women's Health & Gender-Based Medicine 1999; 8:1185-1193

15. Tobin MB, Schmidt PJ, Rubinow DR. Reported alcohol use in women with premenstrual syndrome. Am J Psychiatry 1994; 151:1503-1504.

16. Schnurr PP. Some correlates of prospectively defined premenstrual syndrome. Am J Psychiatry 1988; 145:491-494.

17. Boyle CA, Berkowitz GS, Kelsey JL. Epidemiology of premenstrual symptoms. Am J Pub Health 1987;77:349-350.

18. Chuong CJ, Burgos DM. Medical history in women with premenstrual syndrome. J Psychosom Obstet Gynaecol 1995; 16:21-27.

19. Stueve A, Dohrenwend BP, Skodol AE. Relationships between stressful life events and episodes of major depression and nonaffective psychotic disorders: selected results from a New York risk factor study. In Dohrenwend BP (ed.) Adversity, Stress, and Psychopathology. New York: Oxford University Press; 1998, p. 341-357.

20. Piltch CA, Walsh DC, Mangione TW, Jennings SE. Gender, work, and mental distress in an industrial labor force: an expansion of Karasek's job strain model. In: Keita GP, Hurrell JJ

(Eds) Job Stress in a Changing Workforce. Washington, DC: American Psychological Association, 1994, p. 39-54.

21. Gutierres SE, Saenz DS, Green BL. Job stress and health outcomes among white and hispanic employees: a test of the person-environment fit model. In: Keita GP, Hurrell JJ (Eds) Job Stress in a Changing Workforce. Washington, DC: American Psychological Association, 1994, p. 107-125.
22. Young EA, Midgley AR, Carlson NE, Brown MB. Alteration in the Hypothalamic-pituitary-ovarian axis in depressed women. Arch Gen Psychiatry 2000;57:1157-1162.
23. Halbreich U. Gonadal hormones, reproductive age, and women with depression. Arch Gen Psychiatry 2000;57:1163-1164.
24. Vincus AA, Ornstein ML, Lentine DA, Baird TU, Chen JC, Walker JA, Kavee JD, Bray RM. *Health Status of Military Females and Males in all Segments of the U. S. Military.* Research Triangle Park, N. C.: Research Triangle Institute 1999.
25. Hourani LL, Yuan H, Bray RM, Wheeless SC. *The health status of women and men in the Navy and Marine Corps: findings from the 1995 Perceptions of Wellness and Readiness Assessment.* San Diego, CA: Naval Health Research Center. Technical Report No. 98-19, 1998.
26. Hourani LL, Graham WF, Sorenson D, Yuan H. *1995 Perceptions of Wellness and Readiness Assessment (POWR'95) Methodology Report.* San Diego, CA: Naval Health Research Center. Technical Document No. 96-9I, 1996.
27. National Center for Health Statistics. Plan and operation of the Third National Health and Nutrition Examination Survey, 1988-94. Hyattville (MD): Department of Health and Human Services; 1994. Series 1, No. 32.

28. Lurie PM, Tyson KW, Fineberg ML, Waisanen LA, Roberts JA, Sieffert ME, Mahoney BS: Analysis of the 1992 DoD survey of military medical care beneficiaries, Office of the Assistant Secretary of Defense, November 1993.

29. Mahoney, BS, Wright, LC: 1989 Department of Defense women's health survey. Defense Manpower Data Center: Arlington, Virginia, 1990.

30. Conway TL, Trent LK, Conway SW: Physical readiness and lifestyle habits among US Navy personnel during 1986, 1987, and 1988. Report NO. 89-24, San Diego, CA: Naval Health Research Center, 1989.

31. Bray RM, Kroutil LA, Luckey JW, Wheeless SC, Iannacchione VG, Anderson DW, Masden ME, Dunteman GH. 1992 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel, Research Triangle Park (NC): Research Triangle Institute; 1992. Report No.: RTI/5154/06-16FR.

32. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36), I. Conceptual framework and item selection. Med Care 1992; 30:473-483.

33. Stewart AL, Hayes RD, Ware JE. The MOS short-form general health survey: reliability and validity in a patient population. Med Care 1988; 26:724-735.

34. Radloff LS: The CES-D scale: A self-report depression scale for research in the general population. Applied Psychological Measurement 1977; 1:385-401.

35. Weissman, MM, Sholomskas, D, Pottenger M, Prusoff BA, Locke BZ. Assessing depressive symptoms in five psychiatric populations: a validation study. Am J Epidemiol 1977; 106:203-214.

36. Mirowsky, J. & Ross, C. E. (1992). Age and depression. Journal Health Soc Behav 33, 187-205.

37. House J. Occupational stress and the mental and physical health of factory workers. Survey Research Center, Institute for Social Research, University of Michigan, 1980.

38.House JS, Wells, JA, Landerman LR, McMichoel AJ, Kaplan BH: Occupational stress and health among factory workers. J Health Soc Behav 1979; 20:139-160.

39. Shah BV, Barnwell BG, Nieler GS: SUDAAN User's Manual, Release 7.0, Research Triangle Park, NC: Research Triangle Institute, 1996.

40. Johnson SR, McChesney, C, Bean JA. Epidemiology of premenstrual symptoms in a nonclinical sample. J Reprod Med 1988;33:340-346.

41. Schuckit MA, Daly V, Herrman G, Hineman S. Premenstrual symptoms and depression in a university population. Dis Nerv Syst 1975; 36:516-517.

42. Bancroft J, Williamson L, Warner P, Rennie D, Smith SK. Perimenstrual complaints in women complaining of PMS, menorrhagia, and dysmenorrhea: toward a dismantling of the premenstrual syndrome. Psychosom Med 1993; 55:133-145.

43. Bancroft J, Rennie D. Perimenstrual depression: its relationship to pain, bleeding, and previous history of depression. Psychosom Med 1995; 57:445-452.

44. Williams KE, Casper RC. Reproduction and its psychopathology. In: Casper RC, editor. Women's health: hormones, emotions and behavior. Cambridge: Cambridge University Press; 1998, p.14-35.

45. Kessler RC, McGonagle KA, Zhao S, Nelson CB, Hughes M, Eshleman S, Wittchen HU, Kendler KS. Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States. Arch Gen Psychiatry 1994;51:8-19.

46. Weissman MM, Klerman GL. Sex differences and the epidemiology of depression. Arch Gen Psychiatry 1977;34:98-111.

47. Wolk SI, Weissman MM. Women and depression: an update. In: Oldham JM, Riba MB, editors. Review of Psychiatry. Washington DC: American Psychiatry Press; 1995.

48. Girdler SS, Pedersen CA, Straneva PA, Leserman J, Stanwych CL, Benjamin S, Light KC. Dysregulation of cardiovascular and neuroendocrine responses to stress in premenstrual dysphoric disorder. Psychiatry Res 1998; 81:163-178.

49. Ramcharan S, Love EJ, Fick GH, Goldrien A. The epidemiology of premenstrual symptoms in a population-based sample of 2650 urban women: attributable risk and risk factors. J Clin Epidemiol 1992; 45:377-392.

TABLE 1. Correlates of premenstrual symptoms or pain (PMS, cramps) among active-duty women

	Total	Cases	Controls	
	% (SE)	% (SE)	% (SE)	Test statistic
Total sample size (unweighted)	6026	3861	2165	
MEDICAL HISTORY				
Current medical conditions				
2 or more	19.99(1.36)	21.77(1.77)	16.04(1.76)	χ^2_2=6.69, p=.0353
1	26.06(1.58)	26.79(1.95)	24.45(2.57)	
None	53.95(1.82)	51.44(2.27)	59.52(2.87)	
Migraine	10.63(1.01)	11.89(1.31)	7.85(1.41)	χ^2_1=4.34, p=.0372
Illness or injury visit in past year				
4 or more	51.05(1.73)	55.88(2.14)	40.11(2.74)	χ^2_2=19.77, p=.0001
1-3	29.17(1.52)	26.81(1.83)	34.52(2.71)	
No visit	19.78(1.51)	17.31(1.79)	25.38(2.70)	
Mental health visit in past year				
1 or more	6.95(.99)	8.23(1.37)	4.05(.79)	χ^2_1=6.85, p=.0089
MENSTRUAL CONDITIONS				
Cramps or pain during periods	24.54(1.44)	33.16(1.95)	5.21(1.12)	χ^2_1=92.18, p<.0001
Heavy periods	36.51(1.78)	47.06(2.19)	12.91(2.01)	χ^2_1=97.80, p<.0001
Light periods	31.10(1.91)	35.49(2.35)	21.27(2.47)	χ^2_1=18.02, p<.0001
One missed period	17.08(1.35)	18.73(1.81)	13.34(1.49)	χ^2_1=5.32, p=.0210
No menstrual periods for 2 or more months	15.77(1.36)	9.86(1.48)	28.99(2.75)	χ^2_1=34.23, p<.0001
Period lasting longer than 1 week	18.25(1.48)	22.16(1.94)	9.49(1.82)	χ^2_1=22.08, p<.0001
Too many periods	11.53(1.10)	13.39(1.40)	7.36(1.70)	χ^2_1=7.30, p=.0069
Bleeding between periods	14.75(1.24)	17.16(1.62)	9.33(1.70)	χ^2_1=10.78, p=.0010
Problem with womb other than endometriosis	2.84(.57)	3.44(.78)	1.51(.61)	χ^2_1=3.75, p=.0528
Abdominal pain (from known cysts or unknown cause)	29.56(1.63)	35.07(2.08)	17.17(2.41)	χ^2_1=28.18, p<.0001
Endometriosis	2.01(.39)	2.36(.50)	1.23(.55)	χ^2_1=2.27, p=.1317

SE = standard error

TABLE 2. Percent demographic distribution of premenstrual symptoms or pain among active-duty women

Demographic variable	Total sample	Cases	Controls	Test statistic
Age				
20 or less	495	84.38	15.62	$X^2_3 = 19.05$, $p = .0003$
21-25	1705	67.14	32.86	
26-34	2178	64.22	35.78	
35 or >	1606	70.99	29.01	
Race				
White, Non Hispanic	3242	73.22	26.78	$X^2_3 = 14.04$, $p = .0029$
Black, Non Hispanic	1030	61.80	38.20	
Hispanic	980	72.66	27.34	
Other	774	66.34	33.66	
Paygrade				
E1-E5	3332	70.42	29.58	$X^2_2 = 2.44$, $p = .2952$
E6-E9	1437	67.59	32.41	
Officer	1257	65.68	34.32	
Marital status				
Not married	3040	69.59	30.41	$X^2_1 = .09$, $p = .7627$
Married	2963	68.68	31.32	
Number of children under 21				
None or less than 3	5619	68.90	31.10	$X^2_1 = 1.33$, $p = .2482$
3 or more	399	75.14	24.86	

TABLE 3: Selected risk factors of premenstrual symptoms or pain among active-duty women

Potential predictor variables*	Sample size	Percent with symptoms	SE	Test statistic
Total sample	6026	69.21	1.53	
Taken birth control pills				
Yes	1797	69.36	2.67	χ^2_1=.03, p=.8615
No	4101	68.79	1.91	
Using Depo-Provera™				
Yes	450	39.48	6.65	χ^2_1=18.82, p<.0001
No	5401	71.07	1.59	
Taken vitamin pills				
Yes	2528	68.18	2.39	χ^2_1=.40, p=.5294
No	3462	70.09	1.96	
Tried to lose weight in the past year				
Yes	4102	73.08	1.67	χ^2_1=13.00, p=.0003
No	1902	60.12	3.07	
Current physical fitness				
Fair/poor	1732	68.81	2.71	χ^2_2=9.32, p=.0095
Good	2307	74.10	2.21	
Very good/excellent	1961	62.68	3.01	
Pregnancy history				
Yes	3417	63.51	2.07	χ^2_1=13.70, p=.0002
No	2589	74.79	2.19	
Age at first live birth				
10-20	749	58.37	4.54	χ^2_2=.69, p=.7070
21-25	1205	62.62	3.53	
26+	871	62.95	3.60	
Age at first menstruation				
<10	148	68.22	8.04	χ^2_3=.50, p=.9182
10-12	2725	70.06	2.10	
13-15	2724	69.62	2.37	
16+	264	65.61	6.31	

Current smokers				
Yes	1477	77.29	2.68	χ^2_1=9.68, p=.0019
No	4451	66.83	1.81	
Days drank alcohol in past month				
11+	507	75.69	4.53	χ^2_3=8.06, p=.0448
4-10 days	1126	75.63	3.07	
2-3 days	2532	67.83	2.35	
None	1838	65.08	2.89	
No. alcohol drinks in past month				
5+	526	82.52	3.58	χ^2_3=10.85, p=.0126
2-4	1532	70.19	2.86	
1	1867	67.01	2.72	
None	2071	65.84	2.71	
Self-perceived state of health				
Fair/poor	300	79.78	4.87	χ^2_2=17.34, p=.0002
Very good/good	4038	71.80	1.78	
Excellent	1673	57.39	3.29	
Depression indicator (CES-D≥6)				
Yes	1729	77.18	2.35	χ^2_1=15.41, p=.0001
No	4046	64.81	1.97	
Overall job stress				
High	2191	78.78	1.93	χ^2_2=34.81, p<.0001
Medium	1925	69.22	2.65	
Low	1732	55.28	3.31	
Depression interaction with abdominal pain				
Depression & abdominal pain	648	89.01	2.34	χ^2_2=46.77, p<.0001
Abdominal pain only	857	75.87	4.16	
Depression only	1072	68.70	3.55	
None	3164	61.80	2.26	

*Other psychosocial variables examined that were not significantly associated with premenstrual symptms include perceived quality of life, positive and negative life events, suicidal ideation, current eating disorder, role limitations due to health or emotional problems, and social support (25).

TABLE 4. Final hierarchical logistic regression model of premenstrual symptoms or pain on psychosocial predictors after controlling demographic variables and lifestyle[1]

	Step I	Step II	Step III
R^2	.03	.10	.13
	OR (95% CI)	OR (95% CI)	OR (95%CI)
Block I: demographics			
Age			
≤20	2.17(1.28,3.67)**	2.33(1.30,4.17)**	2.18(1.20,3.96)**
21-25	.94(.65,1,34)	1.07(.72,1.59)	1.15(.78,1.72)
26-24	.84(.60,1.18)	.86(.60,1.22)	.92(.65,1.31)
35+	Reference	Reference	Reference
Race/Ethnicity			
White or other	1.62(1.17,2.25)**	1.37(.97,1.94)	1.24(.88,1.74)
Black	Reference	Reference	Reference
Block II: lifestyle			
Current birth method			
Birth control pills		.86(.62,1.18)	.88(.64,1.21)
Depo-provera™		.20(.11,.38)***	.18(.10,.32)***
None of above		Reference	Reference
Tried to lose weight			
Yes		1.84(1.34,2.55)***	1.79(1.32,2.43)***
No		Reference	Reference
Pregnancy history			
Yes		.64(.46,.89)**	.58(.42,.79)***
No		Reference	Reference
Heavier drinking			
Yes		1.68(1.11,2.53)*	1.62(1.08,2.42)*
No		Reference	Reference
Block III: psychosocial predictors			
Self-perceived state health			
Fair/poor			2.15(1.07,4.30)*
Very good/good			1.66(1.20,2.30)**
Excellent			Reference
Overall job stress			
High			2.76(1.95,3.92)***
Medium			1.78(1.24,2.54)**
Low			Reference

[1]N (unweighted sample size)= 5406; *$p < .05$;**$p < .01$; ***$p < .001$; OR = odds ratio; CI = confidence interval

REPORT DOCUMENTATION PAGE

1. Report Date (DD MM YY)
14 Nov 2000

2. Report Type
Final

3. DATES COVERED (from - to)
1995-1998

4. TITLE AND SUBTITLE
Psychosocial and Lifestyle Correlates of Premenstrual Symptoms among Military Women

5a. Contract Number:
5b. Grant Number:
5c. Program Element: Reimbursable
5d. Project Number:
5e. Task Number:
5f. Work Unit Number: 6909

6. AUTHORS
Laurel L Hourani, Huixing Yuan, & Robert M Bray

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Health Research Center
P.O. Box 85122
San Diego, CA 92186-5122

9. PERFORMING ORGANIZATION REPORT NUMBER
Report 01-09

8. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)
Research Triangle Institute (RTI)
3040 Cornwallis Road
Research Triangle Park, NC 27709

10. Sponsor/Monitor's Acronyms(s)
TRI

11. Sponsor/Monitor's Report Number(s)

12 DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT (maximum 200 words)

This study examined the prevalence of premenstrual symptoms among a large, population-based sample of reproductive-age, active-duty women. A multivariate approach was used to evaluate the relative importance of psychosocial and lifestyle predictors of premenstrual symptoms or pain after controlling for demographic differences in cases and controls. Premenstrual symptoms were reported by nearly 2 out of every 3 reproductive-age women. Women reporting premenstrual symptoms were more likely to report other symptoms of menstrual dysfunction, 2 or more current medical conditions, migraines, and health care provider visits in the past year. After controlling for the protective effects of taking Depo-Provera and never being pregnant, younger age, trying to lose weight, heavier drinking, poorer self-perceived health, and overall job stress were the most significant predictors of premenstrual symptoms. The greatest risk factor was a high level of job stress, with an almost 3-fold increase in risk relative to those without symptoms.

15. SUBJECT TERMS
Premenstrual symptoms, depression, stress, lifestyle, epidemiology, military

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b.ABSTRACT	b. THIS PAGE			Commanding Officer
UNCL	UNCL	UNCL	UNCL	26	19b. TELEPHONE NUMBER (INCLUDING AREA CODE) COMM/DSN: (619) 553-8429